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Fertility and Female Labor Force Participation: The Role of Legal Access to Contraceptives

Chaney Skadsen
ciskads@ilstu.edu

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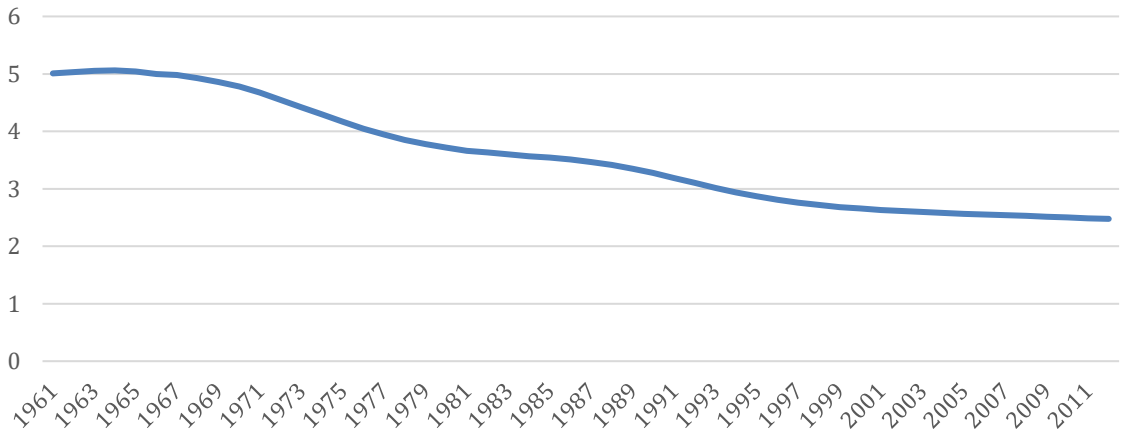
By Chaney Skadsen

1. Introduction

Around the world there has been a global trend of falling fertility rates and increasing female labor force participation rates, simultaneously. The negative association between the two provides impetus to investigate whether fertility acts as an obstruction to the labor market for women and the possibility of incompatibility between motherhood and employee.

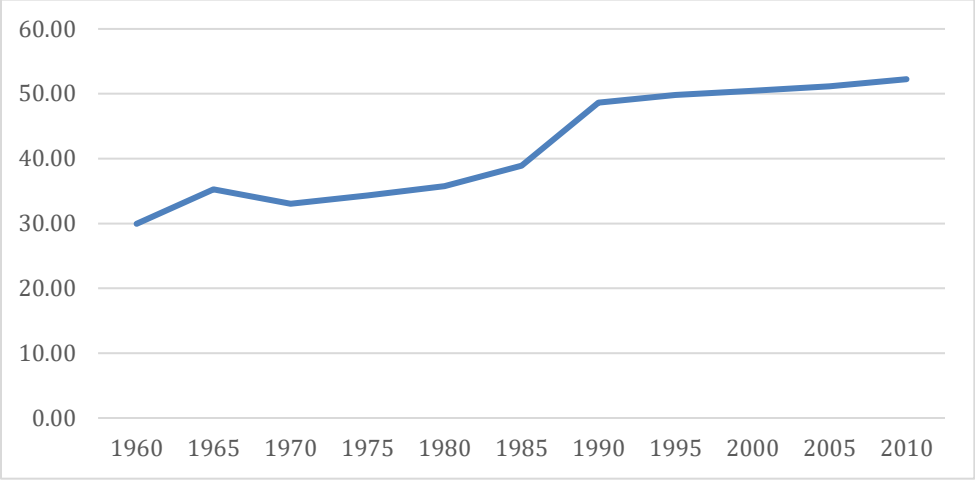
Between the years of 1960 and 2012 fertility has ranged from as high as 7.75 to as low as 1.11 children between 125 countries with a steady decline overtime. The World Bank provides fairly consistent and accurate information for fertility rates globally between 1960-2012. Figure 1 displays this downward trend in average global fertility rates.

Figure 1: Global Fertility Rate



Unfortunately data regarding female labor force participation has not been as accurately reported or collected on an annual basis, although annual data recording has improved since the 1990's. Nonetheless, Figure 2 demonstrates the global increase in female labor force participation rates between 1960-2010 for 5-year estimates. Between the years 1960-2012 female labor force participation has been recorded to be as high as 90.67% and as low as 3.29%. The percentages are the ratio of the amount of women in the labor force divided by the total number of women.

Figure 2: Global Female Labor Force Participation Rate



The relationship between fertility and female labor force participation has been debated for different regions and development level all around the world. For example, there is a discrepancy in the findings for this relationship in developed and OECD countries. In OECD countries the trend in female labor force participation has been relatively increasing consistently since the 1970's, whereas the fertility rates have changed from drops in increases in female labor force participation to increasing post 1980 Ahn and Mira (2002). However, Kögel (2003) finds that this shift in association between fertility and female labor force participation is due to country heterogeneous factors and that the sign between the two has not changed from negative to positive; rather the relationship has just become weaker without a total flip in the sign after 1985.

Countries within the Asian-Pacific region demonstrated no clear pattern between female labor force participation and fertility rates; while in the Middle East and North African (MENA), female labor force participation has continued to be lowest in the world as fertility decreased substantially Lim (2002). In Sub-Saharan Africa countries, on the other hand, have high female

labor force participation rates in conjunction with declining but continuously high fertility rates compared to the rest of the world The World Bank (2015).

These trends and the variation between countries suggest there might be differing causal effects of fertility on female labor participation dependent on region and development level of each country in addition to other heterogeneous factors such as culture, religion, social norms, and gender roles Busso and Fonseca **(**2015).

In this paper, I study the causal effects of changes in fertility effecting female labor force participation rates globally and disaggregated by region and development level using country specific timing on the legislation allowing access to contraceptives. The timing of these laws provides exogenous variability that allows me to employ an instrumental variable (IV) technique to address the endogeneity problem found in fertility.

There are many deviations in the way to study female labor force participation and the relationship between fertility, for the given instruments and estimation techniques chosen. The use of legal access to contraceptives has been utilized as an instrument for fertility while studying developed countries. Therefore, there is a gap in the existing literature for using laws regarding access to contraceptives as instrument for countries that are not developed. This paper will contribute to the literature by filling that gap by using legal regarding access to contraceptives as an instrument for fertility in an international data set of 125 countries for all regions and differing development levels to estimate the causal impact on female labor force participation rates.

Exploring the relationship between fertility and female labor force participation has received a large amount of attention from the United Nations. In 1994 the Cairo Summit discussed the global population and poverty in the context of women. Since the conference, the

United Nation's view altered from one that focused on controlling population growth to the quality of lives around the world. Due to the new emphasis towards improving human rights and the quality of life, delegates from all regions agreed that reproductive rights are human rights and were added to the agenda. Three qualitative goals were then established as a result of the conference: the reduction of infant, child and maternal mortality, the provision of universal access to education, particularly for girls, and the provision of universal access to a full range of reproductive health services, including family planning by 2015.

Possible policy implications arise if reductions in fertility are found to be successful in increasing women's access to participating in the labor force. Therefore, an emphasis should be placed on preventing foreseeable barriers for women to participate in the labor force. In particular, access to contraceptives as an available option to aid desired fertility rates are crucially important for women's autonomy and any action to threat this access can have large externalities.

2. Literature Review

The global trends of falling fertility rates and increasing female labor force participation rates have led to more specific investigations. The relationship has been explored using both micro and macro level data with variation in estimation techniques, regions, development level of countries, and time periods. In addition, the way in which fertility is accounted for as an endogenous variable plays a large role in determining the changes in female labor force participation from changes in fertility.

McNown and Rajbhandary (2003) study the relationship between fertility and female labor force participation for a time series dataset for the United States post World War II. McNown and Rajbhandary (2003) use a co-integration method to tackle the problem of

endogeneity for fertility and find evidence that female labor participation, fertility, female wages, women's educational attainment and male relative cohort size are co-integrated. McNown and Rajbhandary (2003) conclude that female labor force participation responds significantly to changes in fertility.

Engelhardt et al. (2004) examines the relationship between fertility and female labor force participation for six developed countries with a different approach to address fertility endogeneity. They approach the problem of endogenous variables by applying vector error correction models and a co-integration process. They tested for causality using the Granger-causality test with time series techniques and find that reductions in fertility from 1960 to mid 1970 lead to an increase in female labor force participation; however, the relationship became insignificant and weaker after the mid 1970's. They find that variables such as childcare affordability is one of many possible explanations for the change in the relationship between fertility and female labor force participation post mid 1970's Engelhardt et al. (2004).

In addition to co-integration and co-integration vector error correction methods, the use of instrumental variable technique (IV) is a popular method to address fertility endogeniety. Angrist and Evans (1998) are the first to introduce sex composition of children as an instrument for fertility. They use this technique for studying the United States from 1980 and 1990 census data, and find that fertility reduces female labor force supply by 13.3% and 10.4% for 2 or more children in 1980. In 1990 the impact fertility has on female labor force supply is reduced to 6.3% and 8.4% for 2 or more children.

Cruces and Galiani (2007) expand the use of sex composition of children as an instrument for fertility two to Latin American countries and find that fertility lowers female labor force participation. Cruces and Galiani (2007) use Argentina and Mexico country survey data

from 1991 and 2000, and specifically find that in Argentina when a women's fertility is affected by the sex composition of her children reduces her labor supply by 5-6% while having more than two children reduce her labor supply 9-10%. These results are very similar to what is found in Mexico as well, but slightly smaller than Cruces and Galiani (2007).

Tortarolo (2014) expands from Angrist and Evans' (1998) and Cruces and Galiani's (2007) studies by using the same instrument for a larger sample of census data spanning three decades from 14 Latin American countries and the United States (1980s, 1990s, and 2000s). Tortarolo (2014) results are consistent with Angrist and Evans (1998) and Cruces and Galiani (2007) that fertility is statistically significant in explaining changes in female labor force participation for 3 of the countries in the sample, those being Argentina, Mexico, and the United States.

A problem that arises with utilizing this type of instrument to measure the impact that fertility has on female labor force participation is that it requires a lower bound of child bearing. In the studies done by Cruces and Galiani (2007) Angrist and Evans (1998), and Tortarolo (2014) the instrument is dependent on the sex composition of the third child which restricts the subsample to be only assessing those that have already given birth to two children. While the impact of the first child might show a larger variation in a women's preference to joining the labor force versus a mother of two or more children. For my paper the instrument I choose will not fall short to this problem as it does not require a have any exclusionary properties.

Agüero and Marks (2010) expand the investigation of fertility on female labor force participation by using infertility as an instrument for fertility for researching the causal relationship between children and female labor force participation. Using infertility as an instrument for fertility resolves the endogeneity problem because infertility imitates an

experiment in which nature assigns an upper bound for family size independent of the preferences of women. Agüero and Marks (2010) find that for 26 developing countries there is little causal effect for the amount of children and family size to impact female labor force participation. These findings contradict the findings of Cruces and Galiani (2007) and Angrist and Evans (1998). However, they do find that children and family size does impact the type of work a woman pursues.

Cristia (2008) conducts a time series analysis from 1973 to 2002 for the United States using data from the National Center of Health Statistics survey to estimate the causal effect of a first child on female labor supply. Cristia (2008) addresses the problem of endogeneity for fertility by instrumenting it with infertility and miscarriages, similar to what Agüero and Marks (2010) use and find that mothers who pursued medical intervention to conceive experienced a 26% decrease in employment compared to mothers who had not pursued medical attention for infertility.

Bloom et al. (2009) finds a causal effect for reductions in fertility to increases in female labor force participation rate for 97 countries from 1960 to 2000. They address the problem of endogeneity by utilizing abortion legislation as an instrument for fertility. They find that abortion laws are predictive of fertility and that on average; each child born by women between the ages of 20-44 reduces female labor force participation between 5-10%. Their aggregated estimates imply that each birth has a causal reduction of female labor supply by 1.9 years Bloom et al. (2009).

Laws regarding abortion legislation have also been used as an instrument for studying fertility and female labor force participation in the United States alone. Kalist (2004) examines whether the liberalization of U.S. include specific abortion laws that influences female labor

force participation. Kalist (2004) uses several probit participation equations to estimate the impact fertility has on female labor force. He found that legal access to abortions through the channel of reduced fertility were able to increase female labor force participation rates, particularly among single black women.

Bailey (2006) uses variation in United States state laws allowing women under the age of 21 to obtain the first form of oral contraception, *Enovid* without parental consent as an instrument for fertility to measure the effect on female labor force participation. Bailey (2006) finds that from 1970-1990, the legal access to contraceptives for women at a young age increases female labor force participation by about 14%.

The ways in which endogeneity is addressed varies between studies when investigating the relationship between fertility and female labor force participation such as co-integration, vector error correction, probit, and instrumental variable. Popular instruments have included sex composition of children Cruces and Galiani (2007) Angrist and Evans (1998), and Tortarolo (2014), infertility Agüero and Marks (2010) and Cristia (2008), abortion laws Bloom et al (2009) Kalist (2004), and legal access to contraception Bailey (2006), with variation in the development level of the countries that are studied. To the best of my knowledge, there is no paper that has used access to contraception for an international dataset or for developing countries. This paper serves to fill this gap in the literature in an effort to further investigate and understand the relationship between fertility and female labor force participation by utilizing country timing of legal access to contraceptives for an international dataset of 183 countries from 1960-2012.

3. Conceptual Framework

The general negative association between fertility and female labor force participation and the simultaneous shift between the two around the world is arguable evidence for the

incompatibility between child rearing and women's ability to take part and/or stay in the labor force. The negative relationship between fertility and female labor force participation comes from the strain between a woman's role as a mother and as an employee.

Gary Becker outlines a theoretical framework as an explanation for the negative relationship in the context of family economics. Time allocation, specialization, and opportunity costs are some of the mechanisms that generate the negative relationship. Through cost benefit analysis the trade-off between fertility and female labor force participation is explained.

A benefit observed with declining fertility for women is their time can be allocated in ways to increase their human capital. For example, allowing for the ability to secure further education attainment. Partaking in higher education is more easily accessible for women with more available time compared to those that have additional time intensive responsibilities such as those from motherhood. Those that have higher educational attainment demonstrate attractive skills that signal greater ability and are high qualified as employees for the labor market.

Similarly to education, when fertility is reduced the opportunity for further work experience is also more available. The option to focus on their career and invest time in important skills is threatened when time has to be reallocated for child bearing and rearing. This time off can lead to deprecation of human capital. In addition, if her job is labor intensive the recovery from giving birth impacts the amount of work that can be done postpartum and the timing of when she is able to return to work.

In the context of family choices, specialization between parental roles is indicative to the negative relationship among fertility rates and female labor force participation. For example, the absence of accessible and affordable childcare contributes to the trade-off

between motherhood and employee. When childcare costs are comparable to a parent's income the opportunity cost of continuing in the labor market is high. This high opportunity cost leads to parental roles; one specializes in earning an income for the family, while the other focuses on taking care of the children and at home responsibilities.

The gender real wage gap present worldwide increases the opportunity cost experienced by women. The opportunity cost from prolonging or discontinuing work to stay home and take care of children is on average lower in comparison to their male counterparts, which further strengthens the negative relationship for women between employment and motherhood.

Cultural influences such as gender roles are another mechanism for the incompatibility between motherhood and employee exists. For cultures that have dominate ideals that place little emphasis on women working outside of the home leave little example of the benefits for women increasing their human capital. For example, when a women's role does not include employment, human capital skills such as higher education and experience are not emphasized. This perpetuates the gender roles confining women to allocate their time to other culturally appropriate task such as child bearing and rearing.

The reversal effect is also a possibility for the negative relationship between the fertility and female labor force participation. Meaning that women's increased involvement in the labor force has influenced the worldwide reduction in fertility. This can be attributed to the idea that women's participation in the labor market molds their fertility decisions.

Dual direction of causality between the variables is another possibility for the negative relationship between the two and is a result of simultaneous influences and outcomes of each other. This possibility is observed when both the first and second

explanation is presented concurrently. Meaning that fertility obstructs women to participate in the labor force due to allocation of time that limits growth in human capital, while at the same time women also facing lower opportunity costs to forgo work for child rearing than male counter parts which allows their employment opportunities to be molded by their.

The alternative is that the relationship between fertility and female labor force participation is spurious. That is, that the simultaneous shifts of declining fertility and increasing female labor force participation seen around the world are not caused by each other, but rather the changes are unrelated and the two variables are not connected in anyway.

4. Empirical Method

As mentioned in the conceptual framework women's access to the labor market is dependent of their fertility choices, their investment in human capital, and the substitution effect present from the male counter parts. To best understand and identify the causal relationship between fertility and female labor force participation rates OLS estimation will be insufficient. OLS estimation does not indicate directions of causality and is not appropriate for panel data. My contribution to the existing literature will be to expand the literature on how fertility rate impact on female labor force participation rates by utilizing an international unbalanced panel data of 125 counties from all regions and varying development levels.

I will use an instrumental variable technique that will use contraceptive legislature by country to explain endogenous variation in fertility as an impact for female labor force participation. Through using this estimation technique I will be able to capture the causal

impact that fertility has on female labor force participation and account for the endogenous impact of fertility on female labor force participation.

As the evidence of previous studies have pointed out in the literature review, there is a negative correlation between fertility and female labor force participation with evidence from both directions of causality. In order to best estimate the relationship between legal access to contraceptives and fertility the direction of causality is presumed that fertility rates cause a change in female labor force participation, not the alternative. In this case the notion of legal accessibility to contraceptives would not be of a concern. Therefore, my model is stated as:

$$(1)\ FLFP_{it} = \beta_0 + \beta_1 fertility_{it} + \beta_2 educf_{it} + \beta_3 educm_{it} + \beta_4 lifeef_{it} + \beta_5 infant_{it} + \\ + \beta_6 urban_{it} + \beta_7 GNIpc_{it} + u_{it}$$

FLFP stands for the female labor force participation and it defined as a national ratio of women that are working, eligible to be working, and those unemployed but actively seeking employment over the total female population. *Fertility* is defined as the number of children a woman would be expected to have over her fertile years (World Bank 2012). Due to the incompatibility between motherhood and working, the sign on fertility is expected to be negative.

The variable *educf* and *educm* are the average educational attainment for women and men respectively above the age of 15. For the female average educational attainment the expected sign is positive. Additional education increases human capital generating a move attractive candidate for the labor force, which increases the pool of labor market candidates. On the other hand, the expected sign for average male educational attainment is negative. Due to the lack of data available regarding aggregated real wages, *educm* is used

as a proxy for male wages, similar to how Bloom et al. (2009) account for male wages in their paper. The negative sign for men's average educational attainment is generated by the substitution effect from family decision-making. As males' wages increase the female labor force participation rate is expected to fall.

Lifeef is the life expectancy of women; this variable is expected to have a positive sign, as life expectancy is a representation for healthiness. The healthier and the longer living an individual is the more likely they are to participate in the labor market in their lifetime that is why the sign is expected to be positive.

The variable *infant* stands for the infant mortality rate of live births that die before the age of 1 year old of 1000 live births from the World Bank. When an infant dies a mothers time is no longer spent taking care of the infant which allows for more time to be allocated to labor market or in preparation for the labor market through furthered education. Therefore, *infant* is expected to have a positive sign in helping determine female labor force participation rates.

The percentage of the population living in urban areas, *urban*, is included in this study to account for urbanization. The increase to the level of population living in urban areas is expected to have a negative sign for determining female labor force participation rates.

GNIpc is the gross national income per capita and is used a proxy for development level. The data for this variable comes from the World Bank and the intuition for using this variable as a proxy comes from the United Nations Country Classifications. They outline that there are many ways to determine the development level of a country and which category a country falls into. The gross national income per capita is a variable often

utilized to determine the level of development a country is at. There are four categories pertaining to income level. Countries with less than $1,035 GNI per capita are classified as low-income countries, those with between $1,036 and $4,085 as lower middle income countries, those with between $4,086 and $12,615 as upper middle income countries, and those with incomes of more than $12,615 as high-income countries. The countries that fall into the low and lower middle income countries are determined to be lesser developed. Countries are the upper middle income countries are transition economics, and those countries that fall into the high income countries are developed countries.

U is the error term. The subscripts attached to the dependent and independent variables indicate the individual country *i*, and time in years *t.*

Since I am interested in investigating the plausibility of legal access to contraceptives being an unobserved confounder to the negative correlation present between fertility on female labor force participation I will use fertility as a function of the countries legislature on availability for access to contraceptives and include the other independent variables.

$$(2)\ fertility_{ij} = \alpha_0 + \alpha_1 legal_{ij} + \alpha_2 educf_{it} + \alpha_3 educm_{it} + \alpha_4 lifef_{it} + \alpha_5 infant_{it} + \\ + \alpha_6 urban_{it} + \alpha_7 GNIpc_{it} + v_{it}$$

Legal is a dummy variable that takes the value of 1 for when access to contraceptives are legal in a country and 0 when it is not.

Similarly to equation 1 *X* is a vector of country specific characteristics *i* indicates the individual country and *j* is indicative of the time in years.

I choose the instrumental variable technique not only because it has been a popular technique in the literature for this area of study, but also because it provides better insight

for looking at the indirect relationships through endogenous right hand side variables and allows for identifying the direction of causality.

I avoid using OLS estimation methods for this paper for a couple reasons. One is that if I were to include legal access to contraceptive in equation (1) I would not expect there to be a direct effect on female labor force participation. It is through the avenue of fertility rates that one would expect to have an influence on female labor force participation. Another reason I find OLS unsuitable for estimation is that the variable *fertility* can be correlated with the error term. Reasons for this include unobservable characteristics that go in to family planning and fertility rates, such as social norms. Therefore I will add fixed effects to my model to help account for the unobservable heterogeneous characteristics between countries

Utilizing the legal access of contraceptives as an instrumental variable for fertility is justified for many reasons. To begin, we can easily assume that laws regarding contraception do not directly impact the female labor force participation rate or any other omitted variables that contribute to female labor force participation such as skill, ability, and or desire to be participating in the labor force. Therefor the expectation for the covariance between the variables *legal* and the error term in equation (1) is predicted to be zero. In other words we can conclude that legal access to contraceptives is an exogenous variable. Legal access to contraceptives is expected to have a negative correlated with fertility, making it relevant in explaining variations in fertility (the covariance between the two is not equal to zero).

In conclusion, I believe that the unobserved legal access to contraceptive drives the observed negative correlation between fertility rates and female labor force participation,

and that is why I am using a panel fixed effects model with instrumental variable technique over OLS.

5. Data

A compilation of varying data sources and preexisting datasets are utilized to create the unbalanced dataset for this paper. The variables for female labor force participation rates come for the World Bank and the International Labor Organization (ILO). These variables prior to 1990 are only recorded every 5 years for most countries and only every 10 years for others.

Fertility rates, infant mortality rate, life expectancy, and urban population come from the Word Development Indicators (WDI) database generated by the World Bank. These variables are measured annually.

The instrument for this paper- legal access to contraceptives for women- has been recorded and compiled in the dataset "Reproductive Health Laws Around the World" (Canning et al. 2013). This dataset contains a variation of types of contraceptives, such as, the legal sale of the pill, the IUD, and sterilization as forms of contraceptives. This dataset has annual entries comes from the Dataverse at Harvard. This information will be utilized to generate dummy variables deciding whether access to contraceptive is legal annually beginning in 1960. The primary instrument for this investigation is the legal sale of pill.

6. Results

Table 1 is a summary statistics of the included variables for this investigation. Between the years of 1960 and 2010 and across 125 countries (list of countries included in the appendix under Country List), there has been a large distribution of the variable values,

notably for fertility rates and female labor force participations. The fertility rate reaches a maximum of about 7 times the rate of its minimum. Female labor force participation rates have been as low as less than 5% to peeking at a rate over 90%. With large changes between these two key variables I investigate the existence of a causal relationship between changes in fertility leading to changes in female labor force participation.

Table 1:

Variable	Obs	Mean	Std. Dev.	Min	Max
FLFPr	731	0.4737824	0.1756279	0.0329	0.90669
Fert	731	3.288702	1.721233	1.11	7.749
educf	731	6.802175	3.054756	0.37	12.71
educm	731	7.502736	2.629221	1.24	13.36
infant	731	37.64979	34.73791	1.9	184
Legal1 (pill)	731	.6963064	.4601668	0	1
Legal2 (IUD)	731	.6415869	.4798627	0	1
Legal3 (sterilization)	731	.0943912	.2925724	0	1
lifeef	731	70.14081	10.49955	35.351	86.3
urban	731	55.47716	24.11019	4.339	100
GNIpc	731	8177.223	12911.42	120	88430

To begin the investigation to test whether fertility follows the conceptual framework and inhibits female labor force participation, table 2 displays the results of a panel estimation in column 2 without fixed effects and accounting for any endogenous variation in explanatory variables.

Table 2:

Original Regressions		
Dependent Variable: FLFPr		
Fert	-0.04771	***
	(0.007)	
educf	0.017326	**
	(0.00698)	
educm	-0.00504	

	(0.00775)	
infant	-0.00061	
	(0.0005)	
lifeef	-0.01406	***
	(0.00156)	
urban	-0.00272	***
	(0.00033)	
GNIpc	4.71E-06	***
	(5.44E-07)	
intercept	1.672299	***
	(0.1334)	
Method:	**Panel**	
R-Squared:	**.3390**	
Number of observations:	**454**	

When the total fertility rate increases by one child there is an expected fall in female labor force participation by 4.77%. This relationship is statistically significant at the 1% level of significance, economically significant. In addition this model follows the conceptual framework idea of human capital enhancements influence to female labor force participation. *Edudf* is positive and statistically significant at the 5% level and expects that when female average educational attainment increases by 1 year the female labor force participation rate increases by 1.7%.

Before beginning the instrumental variable technique, I test the validity of the chosen instrument, legal access to the pill. First I test if there is high correlation with the endogenous variable fertility and find that in the correlation matrix there is only a correlation value -.0028. Although this is a weaker relationship than expected, when regressing the first stage of the instrumental variable technique I find that legal access to contraceptives is statistically significant in determining changes in fertility at the 5% level of confidence and is possibly a good instrument for this model. Table 3 is the regression

output from the first stage. I chose to include fixed effects into my model because the Hausman test indicated that it would be more appropriate than random effects and improves the model. When legal access to the pill is present there is an expected fall in the fertility rate of .28 children.

Table 3

First Stage results including fixed effects and lag		
Dependent Variable: Fert		
legal	-0.2815	**
	(0.1158)	
lag1FLFPr	0.2270	
	(0.2075)	
educf	-0.0950	
	(0.0478)	
educm	-0.0783	
	(0.0542)	
infant	0.01699	***
	(0.0033)	
lifeef	-0.04913	***
	(0.0099)	
urban	-0.00265	
	(0.0024)	
GNIpc	6.94E-06	***
	(3.82E-06)	
_cons	7.4437	
	0.8286	
Method: Fixed Effects		
R Squared: .7892		
F-Stat: 197.14		
Observations: 454		

The fitted values were saved and used to generate the new variable FertHat02, which is the instrumented variable that accounts for the endogenous variation in fertility. The second stage of this estimation technique is in table 4. When running the regression with the instrumented variable FertHat02, I find that fertility is no longer statistically

significant in explaining female labor force participation rate and fertility has changed signs to being positive.

Table 4

Second Stage results including fixed effects and lag		
Dependent Variable: Female Labor Force Participation Rate		
FertHat02	0.067672	
	0.0775493	
lag1FLFPr	0.1646369	***
	0.043118	
educf	0.0569453	***
	0.011916	
educm	-0.0312243	***
	0.0115687	
infant	-0.0006023	
	0.0014949	
lifeef	-0.003117	
	0.0042185	
urban	-0.001736	***
	0.0004823	
GNIpc	3.84E-06	***
	8.63E-07	
_cons	0.3334031	
	0.5765806	
Method: Fixed Effects		
R Squared: .3007		
F-Stat: 20.22		
Observations: 454		

The second stage to my model in determining female labor force participation finds that the average educational attainment for females is statistically significant and when it increases by one year there is an expected increase to the female labor participation rate by about 5.7%. This follows the conceptual framework that when women's human capital increases they are more likely to participate in the labor market. In addition, the

substitution effect between parents is present and statistically significant. When the average educational attainment for males increases by one year there is an expected fall to female labor force participation rate by 3.1%.

The infant mortality rate and the life expectancy for women are not statistically or economically significant in determining the female labor force participation rate. While both the urban population and the gross national income per capita are statistically significant in determining the female labor force participation rate. When the percent of the population living in the urban area increase by 1% there is an expected fall in the female labor force participation rate by .17%, this aligns with the conceptual framework. Although, gross national income is statically significant, the impact is so small it is not economically significant. For this model the development level plays a very small role in determining female labor force participation.

In efforts to find a better instrument I use the legislation regarding the access to intrauterine devices (IUD). This is a similar instrument to legal access to the pill but varies slightly by the effectiveness and maybe provide as a better instrument. With the pill there is a potentially lower effectiveness due to the nature of the type of birth control. The pill requires daily dosages and is prone to user error which is possible captured by the weaker correlation with fertility than expected. When a day is skipped the quality of the contraceptive is then jeopardized, whereas the IUD does not require daily dosage or much attention from the user.

Legal access to an IUD has a higher correlation with fertility -.0735 than that of the pill. Although, these two variables are not *highly* correlated by any means there is possibility that legal access to IUD's is a more appropriate instrument for fertility

Another instrument attempted is legal access to sterilization. This is a permanent form of contraception. Surprisingly, the correlation between legal access to sterilization as a form of contraceptive and fertility is .1086. The correlation here is the closest to 1 out of all the other instruments, but is not the expected sign. Possible reasons for the positive correlation can be the average age of women choosing this form of contraceptive.

The results from the different instruments are in table 5 including the output from table 4 for comparing purposes. Column 1 has the regression output for the pill as an instrument; column 2 has the output for the IUD as an instrument, and column 3 has the output for sterilization as an instrument.

I find similar results between all columns for the impact that the formation of human capital for women and the substitution effect of males wages. In all columns the proxy variables for these indicators to female labor force participation rates are statistically significant at the 1% level of significance, aside from average female education attainment (*educf*) which is only statistically significant at the 10% level of significance with a p-value of .054. In addition, *urban* and *GNIpc* are statistically significant in all columns at the 1% level of significances but lack economic significance as the coeffiecients are small.

Of the 3 instruments used, only one shows the expected negative sign for the instrumented fertility and is statistically significant, that being when fertility is instrumented with legal access to sterilization as a form of contraceptives. Column 3 shows that when fertility rates rise by one child, there is an expected fall in female labor force participation rates of 28.42%.

The insignificance and positive signs associated with fertility after being instrumented with legal access to the pill and the IUD (columns 1 and 2) can possibly be due to an effect not captured with the variables used in my model but rather are influencing causing a change in sign.

7. Conclusion

In conclusion, fertility only acts as an inhibiter to the labor force for women when instrumented with legal access to sterilization as a form of contraception. Therefore, when permanent forms of contraceptives are legal and available it allows for more women to participate in the labor force and causes an increase in the female labor force participation rate. Possible reasons for this finding and the conclusion drawn from it is that permanent forms of birth control allow women less room for error when avoiding pregnancy, and allows for confident infertility when desired. In addition, this form of contraceptive can be targeted to the older generation of women that are ready to make a permanent decision about their family planning to avoiding unwanted and surprise pregnancies especially at a time when taking off time to raise children would lead to substantial depreciation to human capital.

Although the other forms of contraceptives did not act as strong or appropriate instruments for fertility, legal access to contraceptives are still important for women's health, autonomy and ability to plan for the future. Possible reasons for the pill and the IUD not acting as a good instrument for fertility is that although these forms are legal, they may not be accessible for all women, especially to those than need/want it. For example, the pill and the IUD require monthly and or yearly refills/replacements. The cost of these products might act as an obstruction for users, therefore although these things are legal; they are not

actually assisting with control over fertility. Another possibility is that some women don't have access to the medical facilities that provide these products and services making it difficult to properly control against fertility when not desired.

There is room for expansion in the investigation for whether fertility causes a reduction in female labor force participation in an international dataset like this one. Although my intention was to create a comprehensive study to better understand the causal relationship that lies between fertility and female labor force participation encompassing development level my findings do not strongly address the impact fertility has. Possible expansions to this study include the use of better instruments for fertility that capture the access portion of contraceptives for those that need/want to use it.

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Appendix

Countries List				
Afghanistan	Croatia	Jamaica	Netherlands	Swaziland
Albania	Cuba	Japan	New Zealand	Sweden
Algeria	Cyprus	Jordan	Nicaragua	Switzerland
Argentina	Czech Republic	Kazakhstan	Niger	Syrian Arab Republic
Armenia	Denmark	Kenya	Norway	Tajikistan
Australia	Ecuador	Kuwait	Pakistan	Tanzania
Austria	El Salvador	Lao PDR	Panama	Thailand
Bahrain	Estonia	Latvia	Papua New Guinea	Togo
Bangladesh	Fiji	Lesotho	Paraguay	Tonga
Barbados	Finland	Liberia	Peru	Trinidad and Tobago
Belgium	France	Libya	Philippines	Tunisia
Belize	Gabon	Lithuania	Poland	Turkey
Benin	Ghana	Luxembourg	Portugal	Uganda
Bolivia	Greece	Malawi	Qatar	Ukraine
Botswana	Guatemala	Malaysia	Romania	United Arab Emirates
Brazil	Guyana	Mali	Russian Federation	United Kingdom
Bulgaria	Haiti	Malta	Rwanda	Uruguay
Burundi	Honduras	Mauritania	Saudi Arabia	Vietnam
Cambodia	Hungary	Mauritius	Senegal	Zambia
Cameroon	Iceland	Mexico	Sierra Leone	Zimbabwe
Canada	India	Moldova	Singapore	
Central African Republic	Indonesia	Mongolia	Slovenia	
Chile	Iraq	Morocco	South Africa	
China	Ireland	Mozambique	Spain	
Colombia	Israel	Namibia	Sri Lanka	
Costa Rica	Italy	Nepal	Sudan	

Table 5:

Second Stage results including fixed effects and lag						
Dependent Variable: Female Labor Force Participation Rate						
	The Pill		IUD		Sterilization	
FertHat	0.0676729		.0846248		-.2842345	***
	0.0775493		.078379		.0675069	
lag1FLFPr	0.1646369	***	.1606807	***	.2467644	***
	0.043118		.0431833		.0415051	
educf	0.0569453	***	.0586499	***	.0215587	*
	0.011916		.0119676		.0111459	
educm	-0.0312243	***	-.0300349	***	-.0559146	***
	0.0115687		.0115921		.0110804	
infant	-0.0006023		-.0008988		.0055529	***
	0.0014949		.001508		.0013321	
lifeef	-0.003117		-.0022906		-.0202726	***
	0.0042185		.0042544		.0037687	
urban	-0.001736	***	-.0016984	***	-.0025174	***
	0.0004823		.0004828		.0004668	
GNIpc	3.84E-06	***	3.73e-06	***	6.01e-06	***
	8.63E-07		8.65e-07		8.18e-07	
_cons	0.3334031		.2119898		2.853843	
	0.5765806		.5822881		.5067799	
Method:	**FE**		**FE**		**FE**	
R Squared:	**.3007**		**.3019**		**.3286**	
F-stat:	**20.22**		**20.29**		**23.12**	
Obs:	**454**		**454**		**454**	